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REVIEW OF THE CYNIPID GALL WASPS OF THE GENUS *LOXAULUS* MAYR (HYMENOPTERA: CYNIPIDAE) WITH DESCRIPTIONS OF NEW SPECIES

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Abstract.—Diagnostic characters of the genus *Loxaulus* Mayr and a key to all fourteen species are given. Two species are newly synonymized: *Compsodryoxenus humilis* Weld is a **new synonym** of *Loxaulus vaccinii* (Ashmead) and *Loxaulus ashmeadi* Kieffer is a **new synonym** of *Loxaulus quercusmammula* (Bassett). Lecto- and paralectotypes of *L. beutenmuelleri* Weld, *C. ferrugineus* Gillette, *C. quercusmammula* Bassett, and *C. tenuis* Weld are designated. Two new species, **L. huberi** and **L. masneri** are described.

Key Words: Cynipidae, gall wasps, *Loxaulus,* taxonomy, morphology, distribution, biology

Burks (1979) listed 12 species and one variety for the genus *Loxaulus* Mayr. Subsequently, a new species, *L. boharti* Dailey and Sprenger, was described and species status was given to *L. brunneus* var. *atrior* (Kinsey) (Dailey 1977, Dailey and Sprenger 1983). Thus, the current number of *Loxaulus* species is 14. Herein we synonymize two species, describe 2 new species, *L. huberi* and *L. masneri,* and provide a key to all 14 species.

The identification of the gall wasps of the North American genus *Loxaulus* Mayr (Hymenoptera, Cynipidae, Cynipini) is difficult because the existing keys (Weld 1921, 1952) use a number of unsatisfactory and inadequate diagnostic characters. Furthermore, the nomenclature used to describe taxonomically important structures in the publications prior to the 1960s is inconsistent with current terminology (Dailey and Menke 1980). Various authors have used different terminology to define the same morphological structure and employed the same term for different structures. As a consequence, species have been misunderstood and misidentified.

We follow the current terminology of morphological structures as given in Gibson (1985), Ronquist and Nordlander (1989), Menke (1993), and Fergusson (1995). Abbreviations for fore wing venation follow Ronquist and Nordlander (1989). The measurements and abbreviations used herein include: F1–F12, 1st and subsequent flagellomeres; POD (post-ocellar distance), the distance between the inner margins of the posterior ocelli; and OOD (ocellar-ocular distance), the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye. The width of the radial cell is measured along 2r.

Drawings were made with the aid of a Wild™ drawing tube, scanned into a PC and modified in Adobe Photoshop 3.0.

Material was examined from the follow institutions: National Museum of Natural History, Smithsonian Institution (USNM), Washington, DC, USA; Canadian National Insect Collection, Ottawa, Canada (CNCI); American Museum of Natural History, New York, NY, USA (AMNH); and from the G. Melika private cynipid collection.

Loxaulus Mayr

Loxaulus Mayr 1881: 9, 12, 33. Type species: *Loxaulus mammula* Mayr. Monotypic.

Solenozopheria Ashmead 1887: 149. Type species: *Solenozopheria vaccinii* Ashmead. Monotypic; Weld 1951: 643 (synonym of *Loxaulus* Mayr).

Compsodryoxenus Ashmead 1896: 128. Type species: *Compsodryoxenus maculipennis* Ashmead. Designated by Ashmead 1903: 155; Weld 1921: 234 (key to species); Weld 1951: 643 (synonym of *Loxaulus* Mayr).

Diagnosis.—Length 2.5 mm or less. Head in dorsal view broader than thorax; gena with malar sulcus (Figs. 6, 12). Scutum usually finely transversely coriaceous; scutellum without foveae, with a transverse shallow depression (Figs. 9, 15). Central portion of propodeum narrow, limited by parallel or slightly outward bent lateral carinae and with a median longitudinal carina and/or longitudinal striae; median longitudinal carina in some species indistinct, fragmented, but always present at least in anterior half (Figs. 11, 17). Radial cell of forewing short and broad, not more than 2.5 times as long as broad (except *L. quercusmammula* with radial cell 2.6–2.7 times as long as broad), forewing margin of female with or without cilia, with brown, smoky spots (or stripes) along areolet, 2r, Rs, and M (Figs. 1, 2, 10, 16). Tarsal claws without tooth. Ventral spine of hypopygium short, slender or needle-like; subapical setae short and sparse, not reaching beyond apex of spine and prominent part never more than 3.0–3.5 times as long as broad (Figs. 8, 14).

Discussion.—The propodeum is similar to that of the Mediterranean genus *Plagiotrochus* Mayr. However, in the latter, the central portion of the propodeum is much broader, and is limited by the strongly outward-bending lateral carinae (Fig. 3).

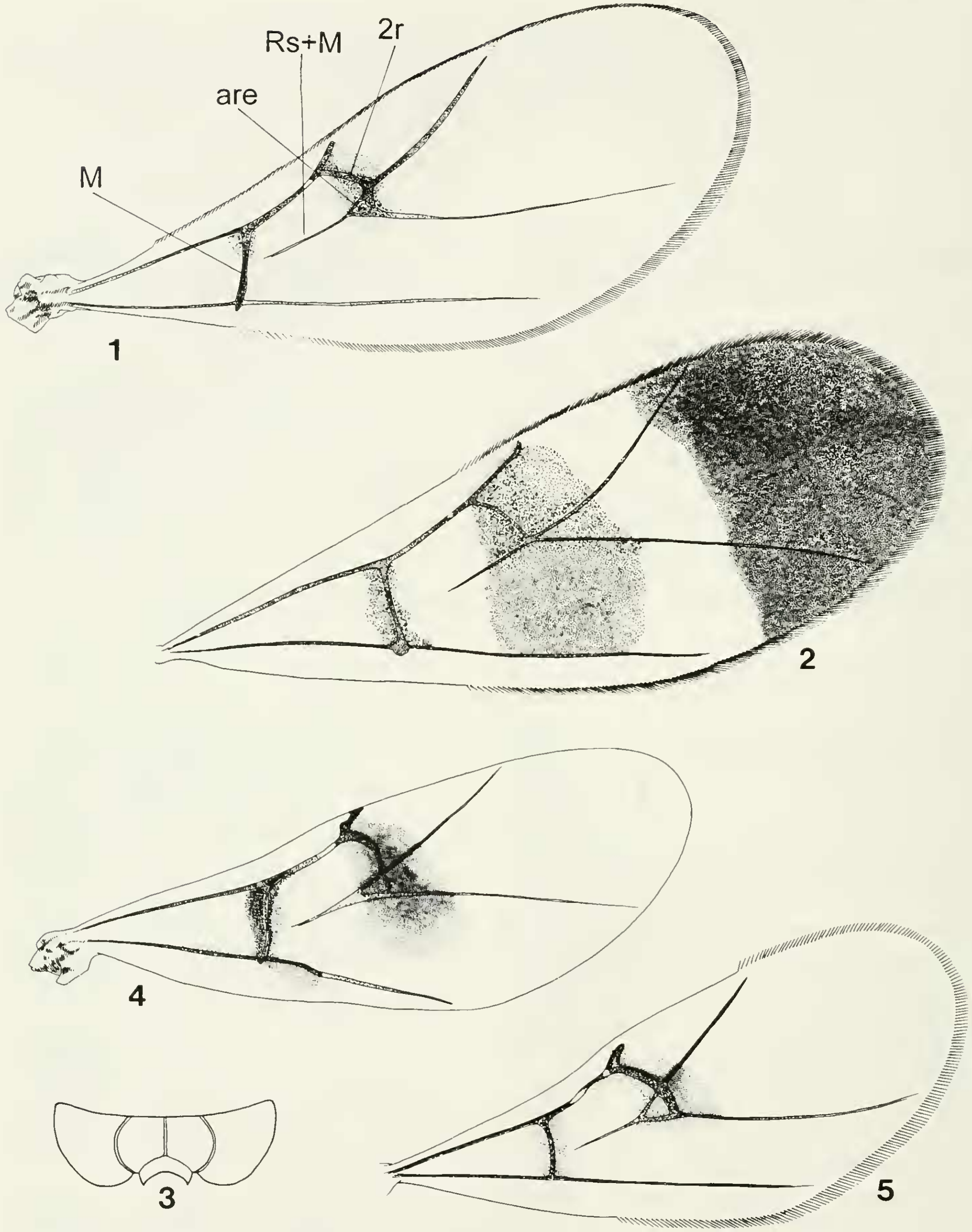
Distribution.—North America only.

Biology.—Alternate unisexual and bisexual generations are known only for *L. trizonalis* Weld.

Weld (1921) published a key to five species. However, a manuscript key to *Loxaulus* species written by Weld includes all the known species and also a number of undescribed species. Weld's manuscript key is on file at the USNM. We credit Weld's useful notes and manuscript keys to the Cynipidae. Herein, we offer a key to all known 14 species.

KEY TO SPECIES OF *LOXAULUS*

1. Female; antenna 12–14 segmented 3
– Male; antenna 15-segmented 2
2. Forewing banded, with two extensive smoky brown spots, radial cell 2.3–2.4 times as long as broad (Fig. 2) . . . . *trizonalis*
– Forewing without smoky spots, or with only a slight indication of very narrow darkish areas along M and around areolet, radial cell 2.6–2.7 times as long as broad (Fig. 1) . . . . *quercusmammula*
3. Antenna 14-segmented 4
– Antenna 12–13 segmented 6
4. Forewing banded, with three extensive smoky brown spots (Fig. 2) 5
– Forewing with narrow dark stripes along M, Rs+M and 2r (Fig. 1) . . . . . . *quercusmammula*
5. Scutum and scutellum same light brown color as sides of mesosoma . . . . *trizonalis*, bisexual generation
– Scutum and scutellum dark reddish-brown, much darker than light brown sides of mesosoma . . . . . . *trizonalis*, unisexual generation
6. Antenna 13-segmented, with distinct suture between F10 and F11 7
– Antenna 12-segmented, indistinct suture indicates F11 whose length equals to F9+F10 . . . . *tenuis*
7. Forewing margin with cilia very short, or absent, with dark spots along areolet, M, and Rs (Fig. 4) 8
– Forewing margin with long cilia, with or without distinct darker spots, but with darker stripes along M and Rs present (Fig. 5) . . 11
8. F12 divided medially by an indistinct suture; F12 nearly equal to F10+F11; disk of scutel-



Figs. 1–5. 1–2, Forewing. 1, *Loxaulus quercusmammula*. 2, *L. trizonalis*, unisexual female. 3, *Plagiotrochus quercusilicis*, propodeum. 4–5, Forewing. 4, *L. maculipennis*. 5, *L. vaccinii*.

lum mostly coriaceous, rugose behind and on sides; length less than 2.0 mm 9

– F12 not divided by a suture; F11 longer than F9+F10; disk of scutellum rugose, edges coriaceous; length 3.6 mm . . . . *maculipennis*

9. Head more than 1.25 times as wide as high, occiput round; inner orbits ventrally diverging; prominent part of ventral spine of hypopygium 1.5–2.0 times s long as broad . . . *atrior*

– Head less than 1.25 times as wide as high, occiput flattened; inner orbits parallel; prominent part of ventral spine of hypopygium 2.0–3.0 times as long as broad 10

10. Notauli complete; prominent part of ventral spine of hypopygium 2.0–2.5 times as long as broad . . . . *brunneus*

– Notauli incomplete; prominent part of ventral spine of hypopygium 3.0 times as long as broad . . . . *boharti*

11. Forewing with dark smoky spot(s) around areolet and/or along M 12

– Forewing with indistinct slightly darker narrow stripes along areolet and/or along M 15

12. Scutellar foveae forming transverse shallow depression, bottom of depression shiny, smooth . . . . *pattersoni*

– Scutellar foveae forming transverse shallow depression, bottom of depression sculptured as rest of scutellum, not shiny and smooth 13

13. Mesosoma longer than high in lateral view, flattened dorsoventrally (Fig. 8); scutum at least 1.2 times as long as broad, with complete notauli; scutellum 1.1–1.2 times as long as broad (Fig. 9) . . . . *huberi*, new species

– Mesosoma nearly as long as high in lateral view, concave dorsoventrally; neither scutum nor scutellum longer than broad; notauli incomplete or absent (Figs. 14, 15) 14

14. Head 1.8–2.0 times as broad as long in dorsal view . . . . *masneri*, new species

– Head 2.3–2.4 times as broad as long in dorsal view . . . . *vaccinii*

15. Scutum longer than broad . . . . *ferrugineus*

– Scutum as broad as long or very slightly longer than broad 16

16. Head, thorax, and 2nd tergum light brown; head 1.1 times as broad or equal to mesosoma; scutum not longer than broad, strongly concave anteriorly; notauli complete, broad in posterior half; mesosoma as long as high in lateral view . . . . *beutenmuelleri*

– Head, thorax, and 2nd tergum dark, reddish-brown; head 1.25 times as broad as mesosoma; scutum slightly longer than broad, flattened dorsoventrally; notauli incomplete, distinct only in posterior ⅓; mesosoma slightly longer than high in lateral view . . . *illinoisensis*

Loxaulus atrior (Kinsey)

Compsodryoxenus brunneus var. *atrior* Kinsey 1922: 49. ♀, gall.
Loxaulus brunneus var. *atrior*. Weld 1951: 643.
Loxaulus atrior. Dailey 1977: 145–146.

Type material examined.—Holotype ♀ "Byron, Cal. Gall 3.19.20\Q. lobata Kinsey coll.\\Comps. atrior Holotype," 13 paratype ♀ with the same labels as the holotype in the AMNH. 2 paratype ♀ in the USNM "Paratype, No. 26117, U.S.N.M.\C. brunneus atrior, Cotype\Q. lobata, Kinsey coll.\\Byron, Cal., Galt 3.19.20."

Diagnosis.—Closely resembles *L. brunneus*, but the head is more than 1.25 times as broad as high; the inner orbits diverge ventrally; the occiput is rounded; the notauli are sculptured and incomplete anteriorly; the scutellar foveae are oval; the central portion of the propodeum has a branched median longitudinal carina; and the prominent part of the ventral spine of the hypopygium is 1.5–2.0 times as long as broad. In *L. brunneus* the head is less than 1.25 times as broad as high; the inner orbits are parallel; the occiput is flattened; the notauli are smooth, shiny, complete; the scutellar foveae are in the form of a transverse shallow depression; the central portion of the propodeum has numerous longitudinal striae; and the prominent part of ventral spine of hypopygium 2.0–2.5 times as long as broad. See also Diagnosis to *L. boharti*.

Distribution.—USA: California (Byron).

Biology.—Only the unisexual generation is known. It induces stem swelling-like galls on *Quercus lobata* Nee. Records of the species on *Q. douglasii* Hooker and Arnott must be confirmed (Dailey 1977).

Loxaulus beutenmuelleri Weld

Loxaulus beutenmuelleri Weld 1957: 116. ♀.

Type material examined.—Lectotype ♀ (here designated), "Evanston, Illinois. Mayr 78\\Paratype No. 63019, U.S.N.M.\\

Loxaulus beutenmuelleri Weld," 8 ♀ paralectotypes (here designated) with the same data. In the USNM. Lectotype and paralectotypes are labeled with red "LECTOTYPE *Loxaulus beutenmuelleri* Weld. Design. G. Melika 998."

Diagnosis.—Antenna 13-segmented; forewing margin ciliate, without dark smoky spots; scutum as long as broad. Closely resembles *L. illinoisensis.* In *L. beutenmuelleri* the head, the mesosoma and the 2nd tergum are light brown; the head is 1.1 times as broad or equal to the mesosoma; the scutum is as long as broad, strongly concave anteriorly; and the notauli are complete. In *L. illinoisensis,* the head, mesosoma, and 2nd tergite are darker, reddish brown; the head is 1.25 times as broad as the mesosoma; the scutum is slightly longer than broad and anteriorly less concave; and the notauli are incomplete, distinct in the posterior ⅓ only.

Distribution.—USA: New Jersey, Pennsylvania, Illinois, Michigan, Virginia (Weld 1957, Burks 1979).

Biology.—Only the unisexual generation is known. It induces leaf galls on *Quercus rubra* L. Galls mature in October and drop to the ground, adults emerge in April–May (Weld 1957).

Loxaulus boharti Dailey and Sprenger

Loxaulus boharti Dailey and Sprenger 1983: 43–44. ♀, gall.

Type material examined.—Two paratype ♀ "California, San Diego Co., 1 km W Jacumba\Loxaulus boharti Dailey & Sprenger\Paratype." In the USNM.

Diagnosis.—Closely resembles *L. brunneus* but the notauli are incomplete and the prominent part of the ventral spine of the hypopygium is 3.0 times as long as broad. In *L. brunneus,* the notauli are complete and the prominent part of the ventral spine of the hypopygium is 2.0–2.5 times as long as broad. See also Diagnosis for *L. atrior.*

Distribution.—USA: California (Anza, Riverside Co.; Byron, Contra Costa Co.). Mexico: Baja California.

Biology.—Only the unisexual generation is known. It induces yellow, pubescent aborted axillary bud or leaf petiole galls on *Q. dunnii* Kellogg. Adults emerge in December and January (Dailey and Sprenger 1983).

Loxaulus brunneus (Ashmead)

Compsodryoxenus brunneus Ashmead 1896: 129. ♀, gall.
Loxaulus brunneus: Weld 1951: 643.

Type material examined.—Type ♀ "Type No. 3085\No. 3045, U.S.N.M.\2972 June 9.83." 4 ♀ "Paratype, No. 3045, U.S.N.M.\2972, June, 83," 2 ♀ "Paratype, No. 3049, U.S.N.M.\Compsodryoxenus brunneus," 1 ♀ "Cotype\Compsodryoxenus brunneus, Ashmead\Beut.coll., rec'd 1935.\2972, June 83\California," 1 ♀ "Paratype, No. 3085, U.S.N.M.\Bred bv. Bassett\Compsodryoxenus brunneus, paratype, Ashm.\2972, June, 83." In the USNM.

Other material examined.—1 ♀ "Loxaulus brunneus, det. Weld (Ash.), 43."\In with N. fragilis Bass. Q. dumosa, San Diego, California\Bred bv. Basset."

Diagnosis.—Closely resembles *L. atrior* and *L. boharti* (see Diagnoses for *L. atrior* and *L. boharti*).

Distribution.—USA: California (San Diego).

Biology.—Only the unisexual generation is known. It induces stem galls on *Q. chrysolepis* Liebmn. (Ashmead 1896).

Loxaulus ferrugineus (Gillette)

Chilaspis ferrugineus Gillette 1891: 200. ♀.
Loxaulus ferrugineus: Weld 1951: 643.

Diagnosis.—Forewing without dark spots, margin ciliate. Closely resembles *L. beutenmuelleri* and *L. illinoisensis* but the head is nearly 1.47 times as broad as the mesosoma; the scutum is longer than broad and the notauli are complete. In *L. beutenmuelleri* and *L. illinoisensis* the head is 1.1–1.25 times as broad as the mesosoma; the scutum is as long as broad; and the notauli are incomplete anteriorly.

Comments.—The type of the species most likely was lost. Weld requested a loan of specimens from the Colorado Agriculture College and received only one specimen (see label data below). This species is represented in the USNM by one specimen from the original Gillette series which bears the labels: red label "Ia. Exp. Sta.," "761," a typed white label "Type," handwritten labels "N.sp. N.g. Andricus," "*Chilaspis sulfur,*" and a subsequently added red label "Paratype No. 27944 USNM" and "Acc No. 71950 USNM to be loaned only to ColoAgCol." This specimen is here designated as lectotype, and a red label was added "LECTOTYPE, *Chilaspis ferrugineus* Gillette. Design. G. Melika 998." The pin includes a single female glued to a fuzzy, yellowish-brown detachable cluster of leaf galls. Gillette (1891) did not provide a description of the gall but wrote "Described from two females taken while ovipositing in galls as above mentioned and one specimen captured at large." This is the syntype series. Supposedly, the gall pinned to the type female was induced by another cynipid, not by *L. ferrugineus.*

Distribution.—USA: Iowa (Ames) (Gillette 1891).

Biology.—Only the female is known. Galls and host associations are unknown. Adults emerge in September (Gillette 1891).

Loxaulus huberi Melika and Abrahamson, new species

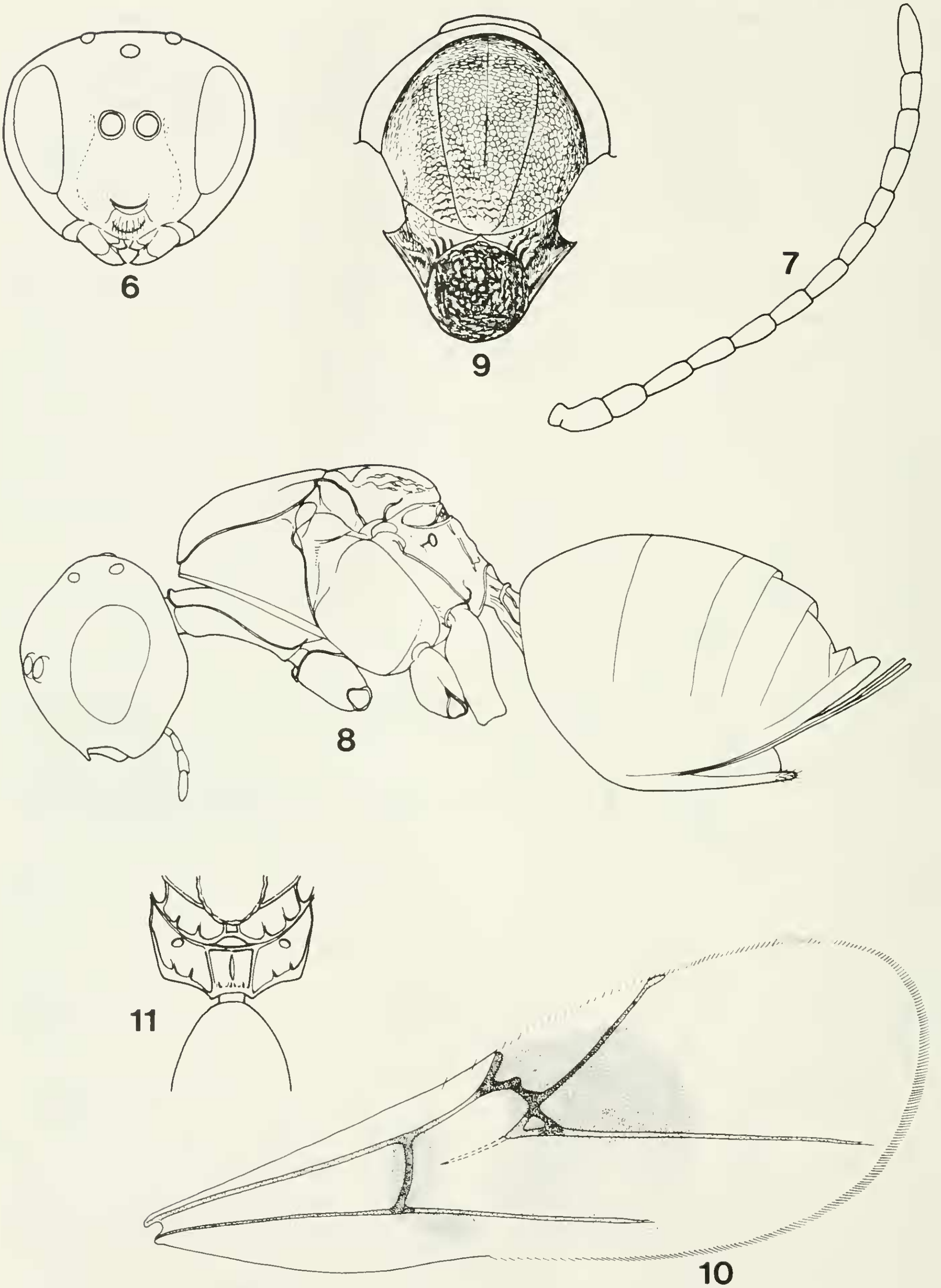
(Figs. 6–11)

Diagnosis.—Similar to *L. masneri* and *L. vaccinii,* however, the mesosoma is longer than high in lateral view and flattened dorsoventrally; the scutum is at least 1.2 times as long as broad, with complete notauli; and the scutellum is 1.1–1.2 times as long as broad. In *L. masneri* and *L. vaccinii,* the mesosoma is nearly as long as high in lateral view and concave dorsoventrally; the scutum and scutellum are nearly as long as broad; and the notauli are incomplete or absent.

Description.—*Female:* Head, thorax, gaster, and legs uniformly yellowish brown, propodeum dark brown. Head broader than thorax, 2.0–2.2 times as broad as long in dorsal view; broader than high in front view, gena broadened behind eye; malar space with sulcus, 3.0–3.3 times as short as eye height (Fig. 6); OOD slightly shorter than POD; head very finely coriaceous; occiput round, not elevated above contour of head. Antenna 13-segmented (suture does not indicate F12), filiform; scape, pedicel, F1–F2 light yellow, following flagellomeres dark brown; scape longer than pedicel, F1 only slightly longer or equal F2, F11 nearly equal F9+F10 (Fig. 7). Mesosoma longer than high in lateral view, flattened dorsoventrally (Fig. 8); scutum at least 1.2 times as long as broad in dorsal view, finely transversely coriaceous, with complete notauli; scutellum 1.1–1.2 times as long as broad, in dorsal view with much rougher sculpture than scutum; scutellar foveae forming transverse shallow depression, bottom of foveae shiny with fine longitudinal parallel striae (Fig. 9). Sides of pronotum and upper ⅔ of mesopleuron shiny, smooth, rest of mesopleuron finely coriaceous. Forewing pubescent, with cilia on margin, with smoky spots, with radial cell 2.2–2.3 times as long as broad; veins brown and with areolet closed (Fig. 10). Tarsal claws simple. Central portion of propodeum narrow, limited by parallel lateral longitudinal carinae, median longitudinal carina complete (Fig. 11). Gaster with petiole as long as mesosoma and head together, nearly as high as long in lateral view. Ventral spine of hypopygium short, slender, with a few short sparse setae, its prominent portion slightly longer than broad (Fig. 8). Length 1.4–1.5 mm.

Gall: Unknown.

Types.—Holotype ♀ and 2 paratype ♀. "USA, AZ, Cochise Co., Huachucha Mts., 5100," Ash Cyn. Road, 13-22.09.993. N. McFarland. Holotype and one paratype de-



Figs. 6–11. *L. huberi.* 6, Head, front view. 7, Antenna. 8, Female body, profile. 9, Scutum and scutellum, dorsal view. 10, Forewing. 11, Propodeum.

posited in CNCI, one paratype in G. Melika private collection.

Etymology.—Named in honor of Dr. J. T. Huber.

Distribution.—USA: Arizona (Cochise Co., Huachucha Mts.).

Biology.—Only the female is known. Adults emerge in March–April.

Loxaulus illinoisensis (Weld)

Compsodryoxenus illinoisensis Weld 1921: 234. ♀, gall.
Loxaulus illinoisensis: Weld 1951: 163.

Type material examined.—Holotype ♀ "Winnetka, ILL. Oct. 30., 1914.\Type 22580." 9 paratype ♀" Compsodryoxenus illinoisensis Weld\Paratype, No. 22580, U.S.N.M.\268\Winnetka, ILL. Oct. 30., 1914." In the USNM.

Diagnosis.—Differs from *L. vaccinii* by the clear forewing, without smoky spots. Closely resembles also *L. beutenmuelleri* but the head, the thorax, and the 2nd tergum are dark, reddish brown; the head is 1.25 times as broad as the mesosoma; the scutum is slightly longer than broad, less concave in lateral view; the notauli are incomplete, narrow and shallow, distinct only in the posterior ⅓; and the mesosoma is as long as high in lateral view. In *L. beutenmuelleri,* the head, the thorax, and the 2nd tergum are light brown; the head is 1.1 times as broad as the mesosoma; the scutum is as long as broad, strongly concave in lateral view; the notauli are complete, with smooth shiny bottoms, broad in the posterior half; and the mesosoma is longer than high in lateral view.

Distribution.—USA: Illinois (Winnetka) (Weld 1921).

Biology.—Only the unisexual generation is known. It induces subterranean stem swelling-like galls, usually at the base of young sprouts of *Quercus macrocarpa* Michaux. The abrupt stem swelling induced is approximately four to five times the normal diameter of the shoot and nearly 30 cm long. Galls mature in fall and adults emerge from the end of October through November (Weld 1921).

Loxaulus maculipennis (Ashmead)
(Fig. 2)

Compsodryoxenus maculipennis Ashmead 1896: 129. ♀, gall.
Loxaulus maculipennis: Weld 1951: 643.

Type material examined.—Holotype ♀ "Compsodryoxenus maculipennis Ash.\No. 2610 May 8.82\Type No. 3084." 11 paratype ♀ "Paratype, No. 3044. U.S.N.M.\2610. May. 82." In the USNM.

Other material examined.—2 ♀ "Ft. Grant, Ariz.\Compsodryoxenus maculipennis Ashmead"; 2 ♀ "Compsodryoxenus maculipennis Ash., det. Weld, 1920\HG Hubbard, Collector\Chirc.Mts, 1–6, -Ar."; 2 ♀ "Ashmead coll.\Cotype\Arizona, Morrison."

Diagnosis.—Forewing margin without cilia, with dark spots along areolet, M and Rs (Fig. 2); no suture indicates F12, F11 longer than F9+F10; disk of scutellum rugose, edges coriaceous. *Loxaulus brunneus* and *L. atrior* closely resemble this species but an indistinct suture indicates F12 which is nearly equal to F10+F11 and the disk of the scutellum is mostly coriaceous, rugose behind and on the sides.

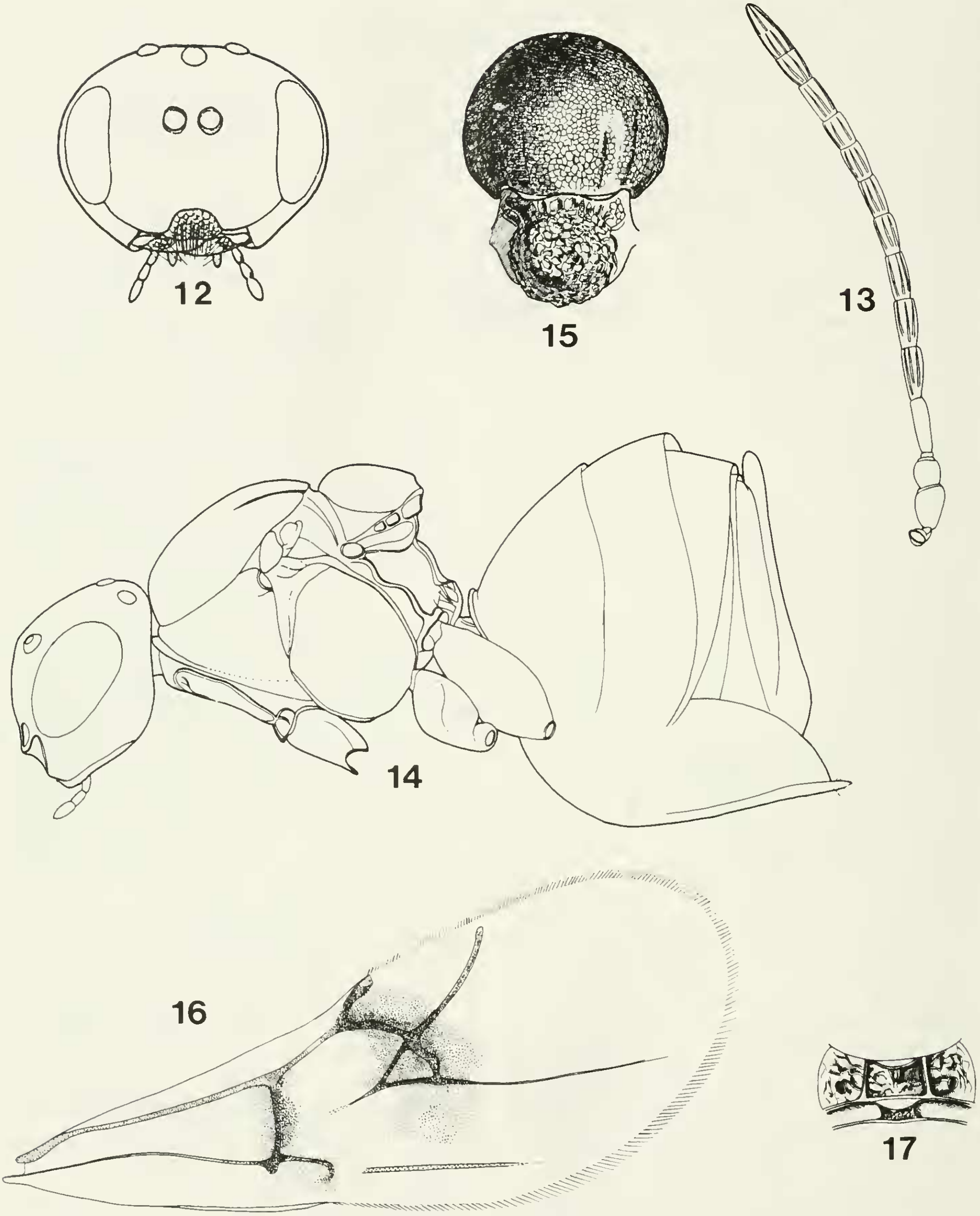
Distribution.—USA: Arizona (Ft. Grant, Chiracahua Mts.).

Biology.—Only the unisexual generation is known. It induces stem swelling-like galls on live oak (Ashmead 1896).

Loxaulus masneri Melika and Abrahamson, new species
(Figs. 12–17)

Diagnosis.—Similar to *L. vaccinii*; however, the head is 1.8–2.0 times as broad as long in dorsal view while in *L. vaccinii* the head is 2.3–2.4 times as broad as long in dorsal view (see also diagnosis for *L. pattersoni*).

Description.—*Female:* Head, mesosoma, gaster, and legs uniformly dark brown. Head broader than thorax, 1.8–2.0 times as



Figs. 12–17. *L. masneri.* 12, Head, front view. 13, Antenna. 14, Female body, profile. 15, Scutum and scutellum, dorsal view. 16, Forewing. 17, Propodeum.

broad as long in dorsal view; broader than high in front view, gena very slightly broadened behind eye; malar space with sulcus, 2.5 times as short as eye height (Fig. 12); OOD nearly equal POD; entire head very finely coriaceous, with sparse short white setae on face; occiput round, not elevated above contour of head. Antenna 13-

segmented (suture between F11–F12 invisible), filiform; scape longer than pedicel, F1 nearly equal to F2, following flagellomeres slightly shorter, F11 slightly shorter than F9+F10 (Fig. 13). Mesosoma 0.8 times as long as high in lateral view, concave dorsoventrally (Fig. 14); scutum slightly broader than long in dorsal view, finely and indistinctly transversely coriaceous, with notauli visible in posterior 1/6 only; scutellum as long as broad in dorsal view, rugose, with much rougher sculpture than scutum; scutellar foveae forming very narrow transverse shallow depression, bottom of foveae rugose (Fig. 15). Sides of pronotum and mesopleuron uniformly finely coriaceous. Forewing pubescent, with cilia on margin; with smoky spots, with radial cell 2.2–2.3 times as long as broad; veins brown, areolet closed (Fig. 16). Tarsal claws simple. Central portion of propodeum narrow, limited by parallel lateral longitudinal carinae, median longitudinal carina incomplete (Fig. 17). Gaster as long as mesosoma and head together, nearly as high as long. Ventral spine of hypopygium very short, slender, with few short sparse setae; prominent portion nearly 2.0 times as long as broad (Fig. 14). Length 1.6–1.8 mm.

Gall: Unknown.

Types.—Holotype ♀ and 3 ♀ paratypes "USA, CA, Barbara Co., 18 mi WNW Cuayama, 12-19.04.988. W. E. Wahl." Holotype and 2 paratype deposited in CNCI, one paratype in G. Melika private collection. The label data must refer to Cuyama in Santa Barbara County.

Etymology.—Named in honor of Dr. L. Masner.

Distribution.—USA: California (Santa Barbara Co., near Cuyama).

Biology.—Female only is known. Adults emerge in April.

Loxaulus pattersoni (Kinsey)

Compsodryoxenus pattersoni Kinsey 1922: 49. ♀, gall.
Loxaulus pattersoni: Weld 1951: 327.

Type material examined.—Holotype ♀ "Austin Tex. Gall 1921, Fall\Q. virginiana, root, Patterson coll.\Compsodryoxenus pattersoni Holotype," 90 paratype ♀ with same labels as holotype in the AMNH. 7 paratype ♀ "Comps. pattersoni, Cotype\Paratype, No. 26114. U.S.N.M.\Q. virginiana, Patterson coll. 18.\Austin, Tex. 29.22." In the USNM.

Diagnosis.—Closely resembles *L. vaccinii* by the similar structure of the scutum and scutellum; however, the scutellum in *L. pattersoni* is longer than broad whereas in *L. vaccinii* it is as long as broad. Also similar to *L. masneri* but F11 is much shorter than F9+F10 whereas in *L. masneri* F11 is nearly equal to F9+F10.

Distribution.—USA: Texas (Austin).

Biology.—Only the unisexual generation is known. It induces root galls on *Quercus virginiana* Mill. (Kinsey 1922).

Loxaulus quercusmammula (Bassett)
(Fig. 1)

Cynips q. mammula Bassett 1881: 76. ♀, ♂, gall.
Loxaulus mammula Mayr 1881: 34; Weld 1926: 45 (biology).
Loxaulus quercus-mammula: Dalla Torre and Kieffer 1910: 386.
Loxaulus quercusmammula: Burks 1979: 1096.
Loxaulus ashmeadi Kieffer 1902: 4. ♀, gall. **New synonymy.**

Type material examined.—51 specimens are deposited in the USNM; of which 46 of these bear a red label "Type," 7 have a red label "Paratype, 27172, U.S.N.M." and with red "Cotype," "Loxaulus mammulus, cotype, Bass.," "Waterbury Ct. H. F. Bassett Coll." Lectotype ♀, 17 ♀ and 14 ♂ paralectotypes bearing the above labels are here designated, red label "LECTOTYPE *Cynips q. mammula* Bassett. Design. G. Melika 998." The type of *L. ashmeadi* Kieffer was not located.

Other material examined.—25 ♀, ♂ in the AMNH from Basset's original series, all labeled "Waterbury, Ct. H. F. Bassett Coll.," "Type."

Diagnosis.—The female closely resembles *L. trizonalis* in that the antenna is 14-segmented, but the forewing has darker stripes only along M, Rs+M, 2r, and the areolet (Fig. 1), whereas in *L. trizonalis* the forewing has two extended dark brown smoky spots (Fig. 2). The male forewing is without smoky spots or with only a slight indication of a very narrow darkish area along M and around the areolet and the radial cell is 2.6–2.7 times as long as broad. In *L. trizonalis* the forewing has two extended brown smoky spots and the radial cell is 2.3–2.4 times as long as broad. Galls resemble those of *L. vaccinii*; thus, adults are required for precise identification.

Comments.—Kieffer (1902) described *Loxaulus ashmeadi* from USA (New England) and noted that it induces galls under the bark of twigs similar to those of *L. quercusmammula*. Kieffer (1902) associated this species with *Quercus robur* L., and suggested that *L. ashmeadi* was introduced to North America from Europe along with its host oak. However, *Loxaulus* is not known from Europe. More likely, the oak host of this species is *Q. alba* L. which was misidentified as *Q. robur*. This species cannot be distinguished from *L. quercusmammula* on the basis of the description of *L. ashmeadi* females given by Kieffer (1902), suggesting that this species is a synonym of *L. quercusmammula*.

Distribution.—USA: New Jersey, Maryland, Connecticut, Virginia (Burks 1979), Florida (Dalla Torre and Kieffer 1910), New England (Kieffer 1902).

Biology.—Only the bisexual generation is known. It induces stem swelling-like galls on *Quercus alba* L. (Ashmead 1885, Weld 1926, 1951, 1959) and *Q. stellata* (Dalla Torre and Kieffer 1910) (this must be confirmed because this host record may refer to *L. vaccinii* and not to this species). Galls occur in June (Weld 1926), adults emerge in July (Weld 1926).

Loxaulus tenuis (Weld)

Compsodryoxenus tenuis Weld 1921: 235. ♀, gall.

Loxaulus tenuis: Weld 1952: 327.

Type material examined.—4 cotype ♀ "Compsodryoxenus tenuis Weld\Cotype No. 22579, U.S.N.M.\Ia—705\Trinidad, Colo, 1917," In the USNM. 1 lectotype ♀ and 3 paralectotype ♀ bearing the above labels are here designated with a red label "LECTOTYPE Compsodryoxenus tenuis Weld. Design. G. Melika 998."

Other material examined.—1 ♀ with labels as lectotype, however without red label.

Diagnosis.—This is the only *Loxaulus* species with a 12-segmented antenna; the forewing margin is ciliate, with a brown smoky spot around the areolet, M, and Rs.

Distribution.—USA: Colorado (Trinidad), New Mexico (Weld 1921).

Biology.—Only the unisexual generation is known. It induces stem-swelling galls on *Quercus undulata* Torr. (= *fendleri* Liebmann) with larval cells hidden under the bark. The slight subterranean enlargements of the stem are about 3–15 mm in diameter. Cells are not scattered uniformly under the bark but situated in groups of 3 to 12 cells in depressions of the wood. Galls occur in July. Adult wasps were dissected from galls in September (Weld 1921).

Loxaulus trizonalis Weld
(Fig. 2)

Loxaulus trizonalis Weld 1926: 45. Adults and galls of alternate unisexual and bisexual generations.

Type material examined.—Holotype ♀ "Loxaulus trizonalis, Weld.\Type, No. 27147. U.S.N.M.\L. H. Weld, Collector.\Q.chrysolepis\Camp.Baldy, July 18. Calif.\Hopk U.S. 15613 b." 66 paratype ♀, ♂ "Loxaulus trizonalis, Weld.\Paratype, No. 27147. U.S.N.M.\L. H. Weld, Collector.\Q.chrysolepis\Camp.Baldy, July 18. Calif.\Hopk U.S. 15613 b." In the USNM.

Other material examined.—27 unisexual ♀ and 27 galls "1577"\Q. chrysolepis\Idyllwild, Cal.21.III.25." In the USNM.

Diagnosis.—Closely resembles *L. quercusmammula* (see Diagnosis for *L. quercusmammula*). Females of the alternate generation differ only very slightly. In the bisexual generation female, the scutum and the scutellum are dorsally the same color as the sides of the thorax, whereas in the unisexual female the scutum and the scutellum are dorsally reddish brown, much darker than the sides of the thorax.

Distribution.—USA: California: Camp. Baldy and Idyllwild in Riverside Co. (Weld 1926).

Biology.—Alternate unisexual and bisexual generations are known. The unisexual generation induces acorn galls while the bisexual generation stimulates stem galls on *Quercus chrysolepis*. The adults of the bisexual generation emerge from the stem galls in April and oviposit into young acorns; galls of the unisexual generation mature in September and the adults emerge the subsequent spring in March or remain in the galls for one year more and emerge in spring of the second year (Weld 1926).

Loxaulus vaccinii (Ashmead)
(Fig. 5)

Solenozopheria vaccinii Ashmead 1887: 134, 149. ♀.
Loxaulus vaccinii: Weld 1951: 643.
Compsodryoxenus humilis Weld 1921: 190, 236. ♀, gall. **New synonymy.**
Loxaulus humilis: Weld 1951: 643.

Type material examined.—*S. vaccinii* holotype ♀ "Jacksonville Fla\Collection Ashmead\Type No. 2884 U.S.N.M.\Solenozopheria vaccinii Ash." In the USNM.

C. humilis holotype ♀ "Compsodryoxenus humilis Weld\Paratype No. 22831 U.S.N.M.\Green Cove Spr., Fla." 6 paratype ♀ with the same labels. In the USNM.

Other material examined.—1 ♀ with "Collection, C. F. Baker\Can 2027.," 2 ♀ with "(Solenozopheria), Loxaulus vaccinii (Ash.), det. Weld\captured\H. K. Townes coll.\Takoma Park, Md., IV-21-44." 3 ♀ with "Solenozopheria vaccinii Ash. det. Weld, 1920.\L. O. Jackson collector\Great Falls, Va., V.10.15." 2 ♂ which Ashmead included in *L. vaccinii* appear to be *Callirhytis* males. 5 ♀ "Ocala Fla\Q. Chapmanii\Rea. red. Oct. 27.22\Hopk. U. S. 15634." In the USNM. 7 ♀ "USA, FL, Highlands Co., Archbold Bio Sta. 1-31.03.1988 MT leg. D. B. Wahl," 17 ♀ "USA, FL, Alachua Co., Gainesville. 23-30.04.1987 leg. D. B. Wahl" in the CNCI.

Diagnosis.—See the key to species and Diagnosis for *L. pattersonae*. The galls are similar to those of *Bassettia floridana* Ashmead, but the larval cells of *B. floridana* are ellipsoid and larger, 3.2 mm long by 1.2 mm in diameter. The cells are not nested as in *B. floridana* galls, but are scattered. The galls are indistinguishable from those of *L. quercusmammula*. Adults are required to separate these species.

Comments.—In the original description, Ashmead (1887) indicated that he obtained only one female which he used to describe the new genus *Solenozopheria* and the species *S. vaccinii*. However, three females and two males with labels "Jacksonville, Fla.," "Collection Ashmead" are in a box labeled "*L. humilis* (Weld)" in the USNM. Two labels identical to these as well as a type label are on the holotype of *L. vaccinii*. We suspect that Ashmead's other specimens were identified later by Weld as *L. humilis*. The examination of holo- and paratypes and all the specimens of *L. humilis* and *L. vaccinii* in the USNM show no differences between the two species. The only difference is that Weld's *L. humilis* specimens are generally darker, but never "nearly black" (Weld 1921). The characters that Weld (1921) provided as diagnostic for *L. humilis* are present in *L. vaccinii* and are variable. The diagnostic characteristics given by Weld for these two species are as follows: scutellar foveae absent, transverse groove on scutellum very narrow, disk of scutellum shiny between numerous and very diminutive parallel striae, which are uniformly distributed along entire length of transverse groove and radiate from disk to scutoscutellar suture; disk of scutellum dull, coriaceous; and notauli incomplete, distinct in posterior one half of scutum but can be indistinct in some specimens. When the notauli are distinct, they are typically smooth and shiny. Consequently, no differences between *L. humilis* and *L. vaccinii* were observed except in coloration. Descriptions of the galls, given by Ashmead (1887) and Weld (1921), for these species are similar. *Loxaulus humilis* causes a stem gall and not a real root gall as Weld suggested. The life histories of the two species are similar.

Distribution.—Weld (1951, 1959) reported the species from Canada to Texas and Florida. Burks (1979), however, stated only Florida, as well as Weld (1921) for *L. humilis* (Ocala, Green Cove Springs, Marianna [Weld 1921]; Archbold Biological Station, Lake Placid, Highlands Co. on *Q. chapmanii* only; vicinities of Orlando, Orange Co.).

Biology.—Only the unisexual generation is known. It induces stem galls, usually located at the base of young sprouts, with larval cells hidden under the bark on *Quercus chapmanii* Sargent and *Q. stellata* Wangenh. (Weld 1921). Galls occur in fall and contain adult wasps in November. The adults emerge the following early spring, in March to April. Ashmead (1887) suggested that the galls occur on *Vaccinium corymbosum,* "but have bred but one fly. Mr. Wm. Brodie, of Toronto, Canada, sent me one specimen of gall exactly like the ones obtained in Florida, and says it is common there on *Vaccinium pennsylvanicum.*" Ashmead incorrectly connected the gall and the gall-inducer. The galls on blueberries are caused by *Hemadas nubilipennis* (Ashmead 1887) of the family Pteromalidae (Chalcidoidea).

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